The Rich Transcription 2006 Evaluation Overview and Speech-To-Text Results

http://www.nist.gov/speech/tests/rt/rt2006/spring/

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Rich Transcription 2006
Spring Meeting Recognition Workshop
at MLMI 2006

Overview

- Rich Transcription Evaluation Series
- RT-06S Evaluation
  - Audio input conditions
  - Corpora
  - STT Evaluation task and results
- Conclusion/Future

The Rich Transcription Task

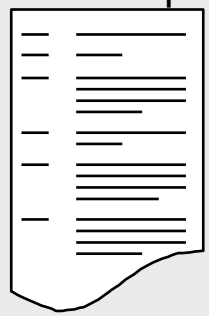
Human-to-Human Speech

Component Recognition Technologies

RICH TRANSCRIPTION
Speech-To-Text + METADATA

Multiple Applications

Readable Transcripts



Smart Meeting Rooms
Translation
Extraction
Retrieval
Summarization
...

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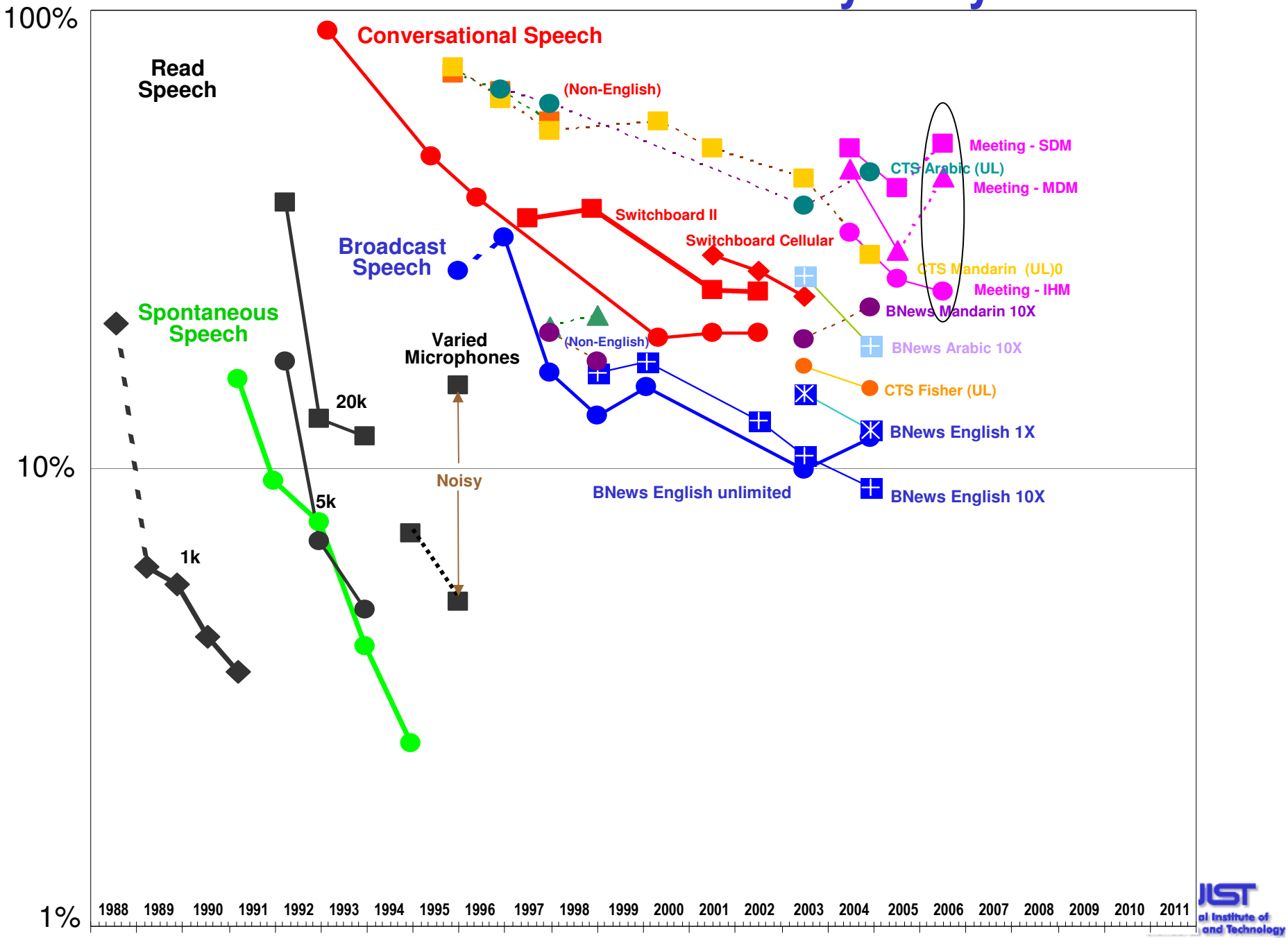
Rich Transcription Evaluation Series

- Goal:
  - Develop recognition technologies that produce language content representations (transcripts) which are understandable by humans and useful for downstream processes.
- Domains:
  - Meeting Room speech
  - Broadcast News (BN)
  - Conversational Telephone Speech (CTS)
- Parameterized “Black Box” evaluations
  - Evaluations control input conditions to investigate weaknesses/strengths
  - Sub-test scoring provides finer-grained diagnostics

NIST STT Benchmark Test History – May. '06



Collaborations

- Augmented Multiparty Interaction (AMI) Program
- Computers in the Human Interaction Loop (CHIL) Program
- Classification of Events, Activities, and Relationships (CLEAR) Workshop
  - NEW EVALUATION

CLEAR Evaluation

- Classification of Events, Activities, and Relationships Evaluation Program and Workshop series
  - Focus is on multi-modal technologies for human activity and interaction analysis
  - Collaboration across programs (like RT)
    - CHIL, VACE in 2005
    - also AMIDA and PETS in 2006
  - Combining video and audio processing and other modalities
  - 23 evaluation tasks supported in CLEAR ‘06
    - Utilized same datasets as RT for some tasks

2006 CLEAR Evaluations

		Source Data					
Task	Sub-condition	Multi-Site Conference Meetings	Seminar Meetings	Surveillance	Broadcast News	Studio Poses	UAV
3D Sing Per Track	Video		CHIL				
	Audio		CHIL				
	Audio+Video		CHIL				
3D Multi Per Track	Video	CHIL					
	Audio	CHIL					
	Audio+Video	CHIL					VACE
2D Multi Per Track	Video			VACE			
2D Face Det	Video	VACE, CHIL	CHIL		VACE		
2D Face Track	Video	VACE			VACE		
Person ID	Video		CHIL				
	Audio		CHIL				
	Audio + Video		CHIL				
Head Pose Est	Video		CHIL			CHIL	
Vehicle Track	Video			VACE			VACE
Acoustic Event Detection	Audio		CHIL				
Environment Class	Audio		CHIL				

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RT-06S Evaluation Tasks

- Focus on core speech technologies – extracting speech content from audio modality
  - Speech-To-Text Transcription
    - Transcribe the spoken words
  - Diarization “Who Spoke When”
    - Identify the number of participants in each meeting and create a list of speech time intervals for each participant
  - Diarization “Speech Activity Detection”
    - Identify the time intervals where one or more people are talking

Six System Input Conditions

- Distant microphone conditions
  - Multiple Distant Microphones (MDM)
    - Three or more centrally located table mics
  - Multiple Source Localization Arrays (MSLA)
    - Inverted “T” topology, 4-channel digital microphone array
  - Multiple Mark III digital microphone Arrays (MM3A)
    - Linear topology, 64-channel digital microphone array
  - All Distant Microphones (ADM)
- Contrastive microphone conditions
  - Single Distant Microphone (SDM)
    - Center-most MDM microphone
    - Gauge performance benefit using multiple table mics
  - Individual Head Microphones (IHM)
    - Performance on clean speech
    - Similar to Conversational Telephone Speech
      - One speaker per channel, conversational speech

Training/Development Corpora

- ICSI Meeting Corpus
- ISL Meeting Corpus
- NIST Meeting Pilot Corpus
- Topic Detection and Tracking Phase 4 (TDT4) corpus
- Fisher English conversational telephone speech corpus
- CHIL ’05 development test set
- CHIL ’06 development test set
- AMI development data
- Rich Transcription 2004 Spring (RT-04S) Development & Evaluation Data
- Rich Transcription 2005 Spring (RT-05S) Evaluation Data

RT-06S Evaluation Corpora

- Two meeting sub-domains
  - Conference Room
    - Multi-site cross-program data collection effort
  - Lecture Room
    - Multi-site CHIL program data collection effort
    - Lecture data further divided into two categories:
      - Seminars
      - Interactive Seminars
- Evaluation corpora used by CLEAR

RT-06S Evaluation Test Corpora: Conference Room Test Set

- Goal-oriented small conference room meetings
  - Group meetings and decision-making exercises
  - Meetings involved 4-9 participants
- 162 minutes – Ten excerpts, each eighteen minutes in duration
  - Six sites donated two meetings each:
    - Carnegie Mellon Univ., Edinburgh Univ., IDIAP (donated, but not used), NIST, TNO, and Virginia Tech (VT)
  - Similar test set construction used for RT-05S evaluation
  - Transcribed by the LDC
- Microphones:
  - All participants wore head microphones
  - Microphones were placed on the table among participants
  - AMI meetings (Edinburgh, IDIAP, and TNO) included an 8-channel circular microphone array on the table

RT-06S Evaluation Test Corpora: Lecture Room Test Set

- Technical lectures in small meeting rooms
  - Educational events where a single lecturer is briefing an audience on a particular topic
- 190 minutes – 38 excerpts from 26 lectures
  - Two styles of lectures:
    - Seminar Lectures: One lecturer, large audience (between 4 and 15 people) (120 minutes)
    - Interactive Seminars: One lecturer, small audience (usually 4, sometimes more people) – 70 minutes
- Data collected at
  - AIT, IBM, ITC, Karlsruhe University, UPC
- Sensors:
  - Seminar Lectures:
    - Lecturer wore head mic, variable number of audience members wore head mics
  - Interactive Lectures:
    - Lecturer wore head mic, all audience members wore head mics
  - Microphones were placed on the table among participants
  - Inverted 'T' source localization array mounted on walls
  - Mark III mounted on the wall opposite the lecturer

Scoring/Data Problems

- Performance for 4-person speech is actually worse than reported
  - a newly discovered reference problem caused some 3-person speech segments to be scored as 4-person speech segments

- Conference Room Data
  - TNO's distant microphone data was found to be corrupt and therefore removed from distant mic scoring
- Lecture Room Data
  - American vs. English spellings (both systems and references)
  - Some IHM Channel-to-Speaker ID correspondences are incorrect and need to be re-checked
  - Three segments were transcribed for the wrong time and need to be added back into the scoring

RT-06S Evaluation Participants

Site ID	Site Name	Evaluation Task		
		STT	SPKR	SAD
AIT	Athens Information Technology		X	X
AMI	Augmented Multiparty Interaction Program	X	X	X
IBM	IBM	X		X
ICSI/SRI	International Computer Science Institute and SRI International	X	X	X
INRIA	Institut National de Recherche en Informatique et en Automatic			X
ITC-irst	Center for Scientific and Technological Research			X
KU	Karlsruhe University (UKA)	X		
LIA	Laboratoire Informatique d'Avignon		X	X
LIMSI	Laboratoire d'Informatique pour la Mécanique et les Sciences de l'Ingénieur	X	X	X
UPC	Universitat Politècnica de Catalunya			X

Speech-To-Text (STT) Task

- Task definition
  - Systems output a single stream of time-tagged word tokens
- Several input conditions:
  - Conference Room: **MDM(primary)**, SDM, ADM, IHM
  - Lecture Room: **MDM(primary)**, MM3A, MBF, ADM, SDM, IHM
- Participating sites:
  - Conference Room: AMI, ICSR/SRI, UKA
  - Lecture Room: AMI, IBM, ICSI/SRI, LIMSI, UKA

STT System Evaluation Method

- Primary metric
  - **Word Error Rate (WER) -** ratio of inserted, deleted, and substituted words to the total number of words in the reference
    - System and reference words are normalized to a common form
    - System words are mapped to reference words using a word-mediated dynamic programming string alignment program
- Systems were scored using the NIST Scoring Toolkit (SCTK) version 2.1.3
  - Handles simultaneous speech
    - Periods with up to 4 overlapping speakers evaluated for Distant microphone conditions
  - Two supported STT evaluation paradigms
    - Single Stream STT system output to Multi Stream References
    - Multi Stream STT system output to Multi Stream References
    - LREC 2006: Multiple Dimension Levenshtein Edit Distance Calculations for Evaluating Automatic Speech Recognition Systems During Simultaneous Speech

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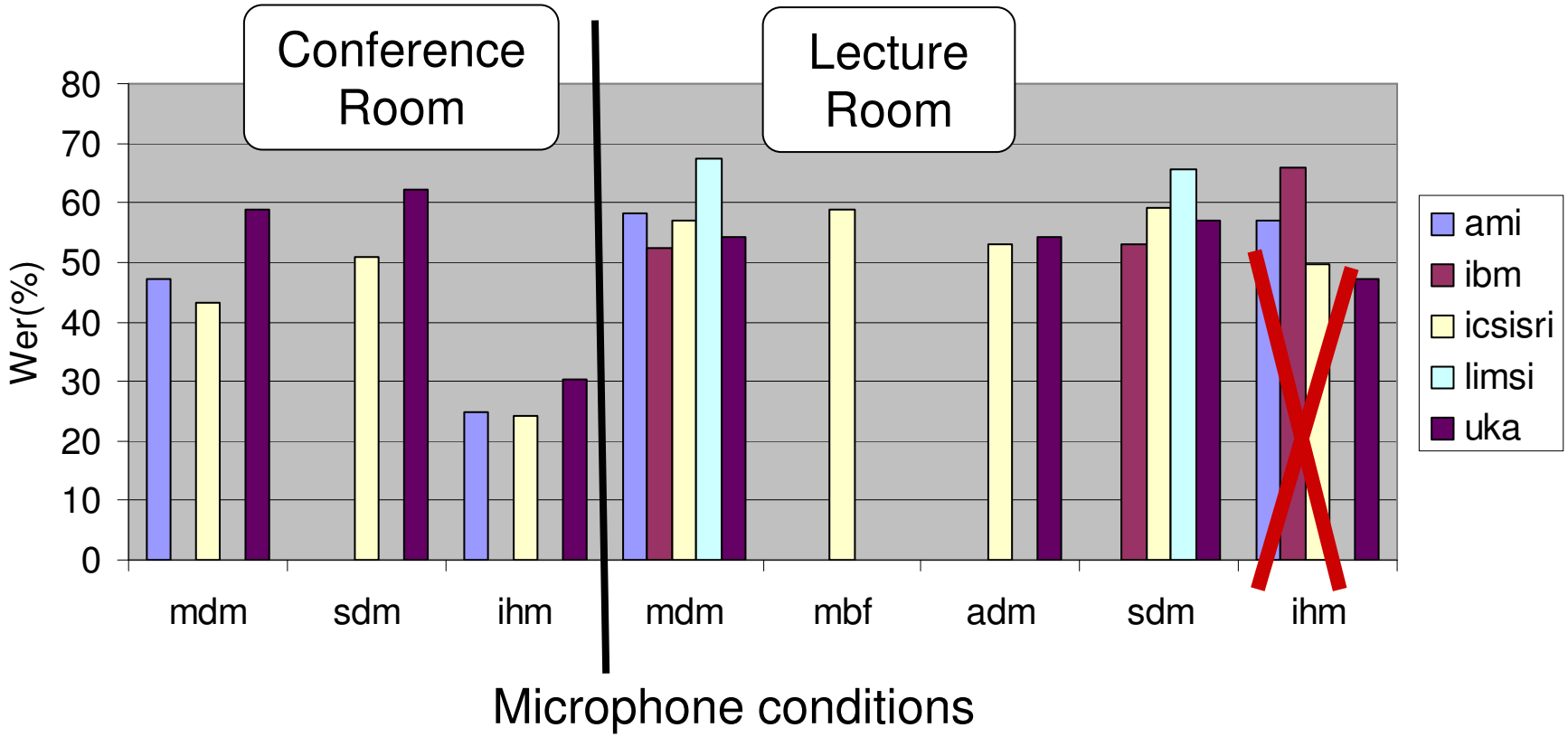
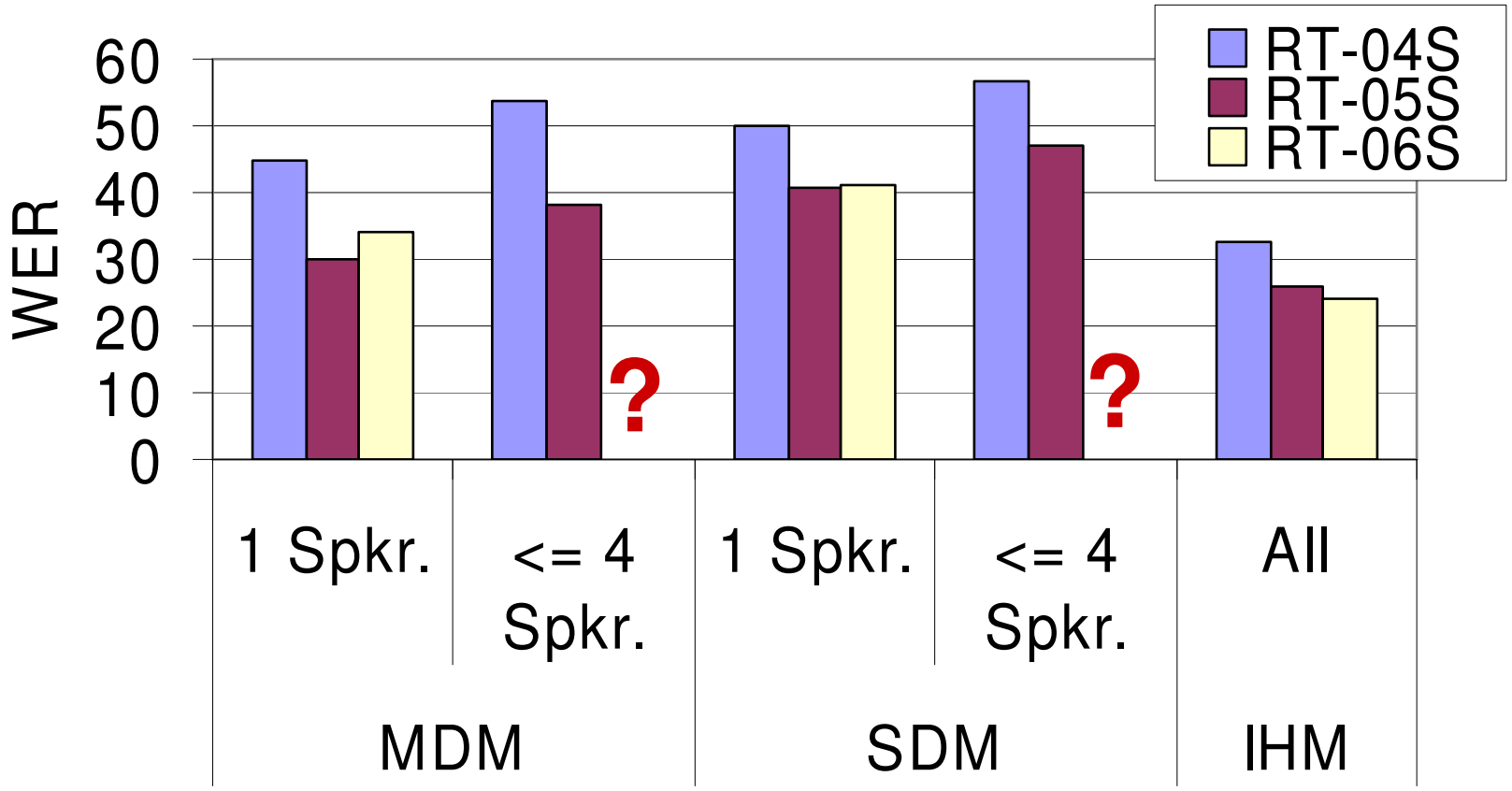
RT-06S STT Primary System Results (Current Overlap<=4 Results)



- Conference MDM error rates are higher than last year
- Lecture IHM results will be revised

Historical STT Performance in the Conference Meeting Domain



- Current Overlap<=4 WERs aren't compatible with '05 but they are definitely higher than '05
- RT-06S set looks more difficult in terms of acoustic challenge, but not language

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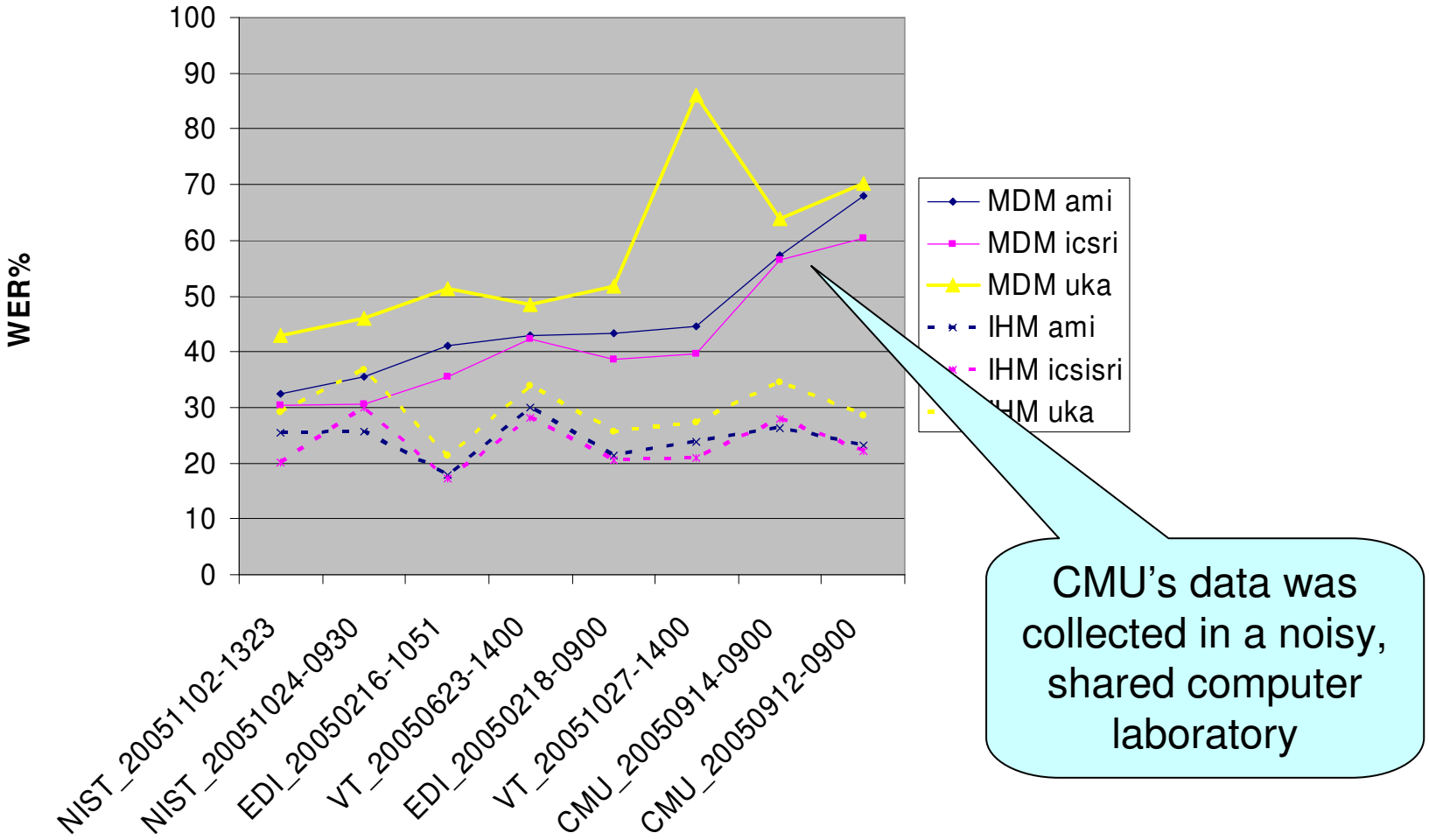
Conference Data by Meeting ID

IHM and MDM Results for Primary Systems



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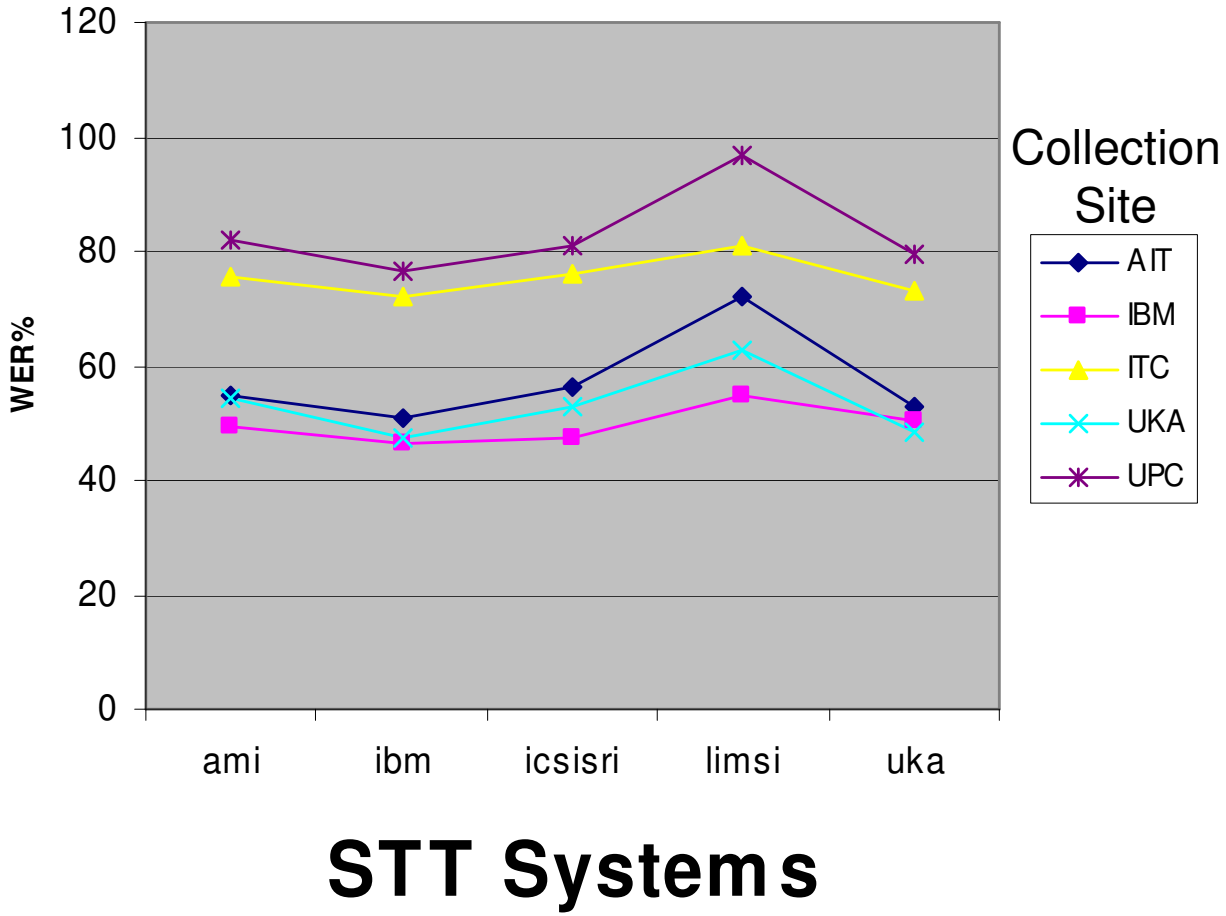
Lecture Data by collection site

Current MDM Results for Primary Systems



Horizontal separation

- Background acoustics
- Accent/Training Data

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Next Steps/Conclusions

- We need to plan in time for reference fixes in the future
- A decision needs to be made to either have every one run the missing TNO distant mic data for the conference data or leave it out of the official scores
- Scores need to be finalized
  - Lecture IHM results need re-scored
  - All distant mic conditions need to be re-scored
    - Conference error rates will increase
    - Lecture data will not change much
- Schedule for system description papers needs to be softened